First Year: Conclusions

Summary of conclusions drawn from 1-D registration and 2-D automatic landmark selection.

Revised Version

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REGISTRATION EXPERIMENTS - OVERVIEW

- Registration of 1-D data, which is guided by minimisation of their model, leads to reasonable results*.
- Quality of results can be estimated either by looking at the correct solution or measuring mean of squared differences.
- Registration is better off driven by using model of data intensity (i.e. values). The model of the warps confines progress.

*Assumption to note is that experiments are performed over a half-ellipse which varies in height, width and horizontal orientation.

REGISTRATION EXPERIMENTS - OVERVIEW - CTD.

- Models of inverse deformation can encapsulate all data before it was registered. This is a powerful property.
- A suitable warp that is invariantly diffeomorphic is the single-point clamped-plate spline.
- Specificity appears unaffected before and after model-based registration, yet it does not imply lack of convergence. Mean specificity remains the same while its range of values decreases.

This is due to the model becoming more concise and less variable. As a result, outliers are rarely chosen.

REGISTRATION EXPERIMENTS - OVERVIEW - CTD.

- Mean-squared-differences among bumps decreases after model-based registration, as expected. This decrease seems exponential, much like the log of the determinant of the model.

- Generalisation ability remains unchanged after model-based registration. This is not surprising.

REGISTRATION EXPERIMENTS - EFFICIENCY

- Eigen-analysis consumes most of the time that is required for model-based registration.
- Many unwanted choices of warp are made in the process. A great deal of effort is put into choosing random warps that get thrown away.
- Optimiser tolerance must become data-driven.

REGISTRATION EXPERIMENTS - EFFICIENCY - CTD.

- On a modern machine, sensible registration of 'normal' 1-D sets takes about 10 minutes. This can be sped up considerably. One way of doing so is by selecting an appropriate tolerance for the optimisation. Another is by choosing stochastic sub-sets to reduce the scale of the problem. There is also potential for a more cunning choice of warps.

REGISTRATION - SETS AND SUBSETS

- Stochastic choice of data subsets can be used to infer data variability. Uncertainty is related to the change in determinant value.
- Subset-based registration appears slow. This is yet inconclusive.
- The model-based objective function is less effective when the set to register is large.

REGISTRATION - COMPARISONS

- Model-based registration is slower than MSD-based registration.

REGISTRATION - CORRECTNESS

- One possible way to validate registration is by looking at the correct solution.

- Data drifts away as registration proceeds. Registration goes below target as a result.

REGISTRATION - CORRECTNESS - CTD.

- Discrepancies of the model must be taken into account in the objective function.

- The algorithm must be stopped at the stage of near convergence. Otherwise, data is warped to fit an improper model.

SHAPES - GENERAL

- Use of subsets in selection of landmarks is slower. Quality of selection is also poorer.
- Tolerance of optimiser must not be chosen arbitrarily.
- Without use of proper integral (of the covariance matrix) term, the optimisation will not work as expected.

SHAPES - GENERAL - CTD.

In the case of brick-and-bump, varying the height of bumps affects quality of selection. Therefore, arguments about robustness can come up.